

Research Note

Hatching Dynamics of Eggs as Further Evidence for the Existence of Two Separate Species of *Sphaeridiotrema* (Digenea) in Eastern North America

CHRISTOPHER W. MCKINDSEY AND J. DANIEL McLAUGHLIN

Department of Biology, Concordia University, 1455 de Maisonneuve Boulevard West,
Montréal, Québec, Canada H3G 1M8

ABSTRACT: The hatching rate and success was determined and compared for 2 recently distinguished species of digeneans in the genus *Sphaeridiotrema*: *S. globulus* and *S. pseudoglobulus*. Hatching success did not differ between the 2 species, but the mean hatching time at 20°C for *S. pseudoglobulus* (18.0 ± 0.1 days) was almost 10 days less than that observed for *S. globulus* (27.9 ± 0.2 days). These results provide further evidence for the existence of 2 separate species.

KEY WORDS: *Sphaeridiotrema globulus*, *Sphaeridiotrema pseudoglobulus*, eggs, hatching.

Recent studies (McLaughlin et al., 1993) have demonstrated that 2 species of *Sphaeridiotrema* (Digenea) occur in waterfowl in eastern North America. *Sphaeridiotrema globulus* (Rudolphi, 1814) occurs in waterfowl in New England (Roscoe and Huffman, 1982, 1983); *Sphaeridiotrema pseudoglobulus* McLaughlin, Scott, and Huffman, 1993, occurs in waterfowl along the St. Lawrence River and its tributaries in southern Québec (Hoeve and Scott, 1988). Both species have been implicated in waterfowl mortality (Price, 1934; Huffman and Roscoe, 1986; Hoeve and Scott, 1988). The life history stages and intermediate hosts of both species are known from natural infections (Huffman and Fried, 1983; Ménard and Scott, 1987). However, neither life cycle has been studied experimentally and few details are available.

This study examines the comparative hatching dynamics of the eggs as part of a larger study on the life cycles of the 2 species. An unexpected consequence of this work was the observation that the egg hatching dynamics differed significantly between the 2, providing further evidence to separate *S. globulus* from *S. pseudoglobulus*.

Metacercariae of *S. pseudoglobulus* were obtained from naturally infected *Bithynia tentaculata* collected from Rivière du Sud, Québec, Canada. Metacercariae of *S. globulus*, obtained from naturally infected *Goniobasis virginica* from Lake Musconetcong, New Jersey, were kindly supplied by Dr. J. E. Huffman, East Stroudsburg

University of Pennsylvania. Three lots of about 65 *S. pseudoglobulus* and 5 lots of about 65 *S. globulus* metacercariae were fed to 3 and 5 12-day-old pekin ducklings (*Anas platyrhynchos dom.*) (Brome Lake Duck Farms, Knowlton, Québec), respectively. Eggs were harvested on days 5 and 6 pi by passing the duck droppings through a series of screens (120, 70, and 37 μ m). The eggs were caught on the 37- μ m screen and separated from the fine debris by repeated sedimentation. Eggs collected on days 5 and 6 pi were pooled and, for experimental purposes, assumed to have been collected at the same time.

For each species, 6 24-well tissue culture plates were filled with water (3 ml/well), and a single egg was deposited in each well. The plates were then incubated simultaneously at 20°C ($\pm 1^\circ$ C) under constant incandescent illumination. Eggs were examined daily for 40 days and were considered hatched when the operculum was open and the miracidium was free of the egg. Eggs not hatching during this period or not exhibiting development were considered dead.

There was no significant difference in hatching success between the two species (*G*-test, $G = 3.06$, $P = 0.080$). Overall, 90% of the *S. pseudoglobulus* and 83% of the *S. globulus* eggs hatched. The hatching times of all viable *S. pseudoglobulus* and *S. globulus* eggs are shown in Figure 1. There was almost no overlap in hatching times observed between the 2 species, and a highly significant difference in mean hatching time was found (Mann-Whitney *U*-test, $Z = 13.787$, $P < 0.00005$). The mean number of days required for hatching (\pm SE) was 18.0 ± 0.1 for *S. pseudoglobulus*, whereas eggs of *S. globulus* required, on average, 27.9 ± 0.2 days to hatch.

Sphaeridiotrema globulus and *S. pseudoglobulus* exhibit substantial overlap in morphometrics. The major difference between the 2, as determined from experimental populations, is egg size. Live *S. pseudoglobulus* eggs from feces mea-

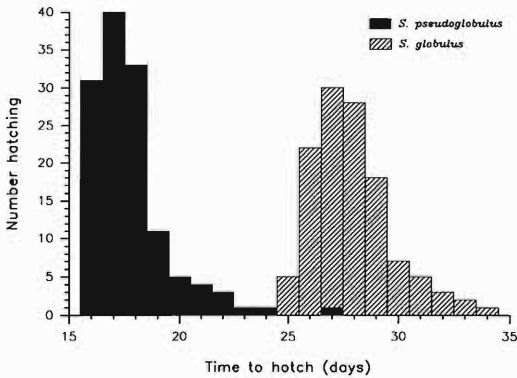


Figure 1. Hatching times of *Sphaeridiotrema pseudoglobulus* (solid bars) and *Sphaeridiotrema globulus* (diagonally striped bars) eggs maintained under identical conditions at 20°C with constant light.

sure, on average, $126 \times 82 \mu\text{m}$, whereas those of *S. globulus* measure $105 \times 73 \mu\text{m}$ (McLaughlin et al., 1993). Features such as egg number (mean in utero number of 9 in *S. pseudoglobulus*, 23 in *S. globulus*) and cirrus shape are also useful in distinguishing between the 2 species (McLaughlin et al., 1993). Pathogenicity of the 2 species also differs. Pekin ducklings and blue-winged teal (*Anas discors*) do not develop enteritis comparable to that caused by *S. globulus* in mallards (*Anas platyrhynchos*), Canada geese (*Branta canadensis*), or mute swans (*Cygnus olor*) described by Huffman and Roscoe (1989) when infected experimentally with comparable numbers of *S. pseudoglobulus* (Gagnon, 1990). Nonetheless, the massive infections of *S. pseudoglobulus* present in ducks found dead compared to the numbers seen in healthy, hunter-shot ducks suggests that this helminth may well be a factor in waterfowl mortality (Hoeve and Scott, 1988), although the mechanism clearly differs from that of *S. globulus*. Differences in the egg-hatching dynamics reported here provide further evidence for the separate identity of the 2 species.

We thank Dr. Jane Huffman, East Stroudsburg University of Pennsylvania, for the *S. globulus*

metacercariae. The work was supported in part by a Concordia University Faculty Development Research Grant to J. D. M.

Literature Cited

- Gagnon, C. 1990. Pathological consequences of infection by *Cyathocotyle bushiensis* Khan, 1962 and *Sphaeridiotrema globulus* (Rudolphi, 1814) in two species of dabbling ducks. M.Sc. Thesis, Institute of Parasitology, McGill University, Montréal, Québec. 167 pp.
- Hoeve, J., and M. E. Scott. 1988. Ecological studies on *Cyathocotyle bushiensis* (Digenea) and *Sphaeridiotrema globulus* (Digenea), possible pathogens of dabbling ducks in southern Quebec. *Journal of Wildlife Diseases* 24:407–421.
- Huffman, J. E., and B. Fried. 1983. Trematodes from *Goniobasis virginica* (Gastropoda: Pleuroceridae) in Lake Musconetcong, New Jersey. *Journal of Parasitology* 69:429.
- , and D. E. Roscoe. 1986. Acquired resistance in mallard ducks (*Anas platyrhynchos*) to infection with *Sphaeridiotrema globulus* (Trematoda). *Journal of Parasitology* 72:958–959.
- , and ———. 1989. Experimental infections of waterfowl with *Sphaeridiotrema globulus*. *Journal of Wildlife Diseases* 25:143–146.
- McLaughlin, J. D., M. E. Scott, and J. E. Huffman. 1993. *Sphaeridiotrema globulus* (Rud., 1814): evidence for two species known under a single name and a description of *Sphaeridiotrema pseudoglobulus* n. sp. *Canadian Journal of Zoology* 71:700–707.
- Ménard, L., and M. E. Scott. 1987. Seasonal occurrence of *Cyathocotyle bushiensis* Khan, 1962 (Digenea: Cyathocotylidae) metacercariae in the intermediate host *Bithynia tentaculata* L. (Gastropoda: Prosobranchia). *Canadian Journal of Zoology* 65:2980–2992.
- Price, E. W. 1934. Losses among wild ducks due to infestation with *Sphaeridiotrema globulus* (Rudolphi) (Trematoda: Psilostomidae). *Proceedings of the Helminthological Society of Washington* 1:31–34.
- Roscoe, D. E., and J. E. Huffman. 1982. Trematode (*Sphaeridiotrema globulus*)-induced ulcerative haemorrhagic enteritis in wild mute swans (*Cygnus olor*). *Avian Diseases* 26:214–224.
- , and ———. 1983. Fatal enteritis caused by *Sphaeridiotrema globulus* (Trematoda) in a whistling swan. *Journal of Wildlife Diseases* 19:370–371.